Corporate Bond Valuation

To price a fixed rate Bond, the future cash-flows are obtained using the given coupon rate and the face value at maturity. To price a Floating Bond, the future cash-flows are obtained using the forward rate from the forecast curve associated with the floating bond and the face value at maturity. The models to price Bond and Floating Bond products are industry standard models,

We use the conventional OAS-spread method. More precisely, the products can be structured into combinations of several cash flow legs, and the PV of each leg can be formulated as

$$PV = \sum_{i=1}^{N} f_i DF(T_{set}, T_i) * e^{-\tau(T_{set}, T_i)s} \quad (1)$$

Where

- DFs are the discount factors, based on proper discount curve at valuation.
- s is the spread that is used to capture market price;
- $(T_1, T_2, \dots, T_n)$ are the pay dates of the cash flow, and assume that$T_0 = 0$;
- $(f_1, \dots, f_n)$ are payments paid at $(T_1, T_2, \dots, T_n)$;
- T_{set} is the settlement time;
- $\tau(t, T)$ is the accrual time in years between t and T.

Conceptually, under the fractional recovery of par assumption, PV for a risky bond can be written as follows

$$PV = \sum_{i=1}^{N} DF_i \, P_s(t_i) CF_i + P_s(t_N) \times DF(t_N) + R \sum_{i=1}^{N} DF_i \left(P_s(t_{i-1}) - P_s(t_i) \right) \quad (2)$$

Where

$(t_1, \dots, t_i, \dots, t_N)$: the scheduled payment time bucket,

CF_i: scheduled payment amount at timet_i.

R: recovery rate

$P_s(t)$: the survival probability up to time t

DF_i: the discount factor for the period $[0, t_i]$.

Here we assume that face amount is 1.

One can see quite clearly from the expression (2) that the present value of the coupon-bearing credit bond does not reduce to a simple sum of contractual cash flow present values using any risky discount function in general. An obvious exception to this is the case of zero recovery assumption, under which the survival probability plays the role of a risky discount function and the formula (2) can be rewritten as the formula (1).

In the literatures, there are two main kinds of models to include credit risk in pricing risky bonds: Reduced form model and structure model.

Structural models are based on the work by Merton and they link firm life to its ability to pay back its debt. The models usually assume that the firm value follows a random process similar to the one used to describe generic stocks in equity markets and it is possible to observe its value at any time. In this way, the default process can be completely monitored based on default free

market information and comes less as a surprise. Structure model is usually not flexible enough to calibrate exactly to structure data such as CDS quotes along different maturities.

The reduced form model describes credit event by an exogenous jump process where the default time t is the first jump time of a Poisson process. The intensity of the process can be either deterministic or stochastic (Cox process). The default is not triggered by basic market observables but has an exogenous component that is independent of all the default free market information. The exogenous component makes default unpredictable in an important technical sense, which can be considered as "positive and realistic features" to model default event [5]. The model is particularly suited to model credit spreads and is easy to calibrate to Credit Default Swap or corporate bond data (see https://finpricing.com/lib/bondTrs.html).

Structural model is appreciated for their economic foundation. But they are deemed to be less flexible and to have less calibration power than reduced form models that are most commonly used in the market to infer implied default probabilities from market quotes.

Conceptually, the model does not integrate issue specific credit information such as recovery rate and issuer's credit rating. To assess credit risk, especially default risk, all relevant liquid deal specific information in the market should be used. The bond spread derived from bond price might contain some credit information of the borrowers. However, the spread also reflects other factors, such as liquidity and taxes. The lack of depth and liquidity of corporate bond poses a significant challenge to extract default risk signals for the bond issuers

Corporate bond spreads, on the other hand, have to be imputed from the yields on government bonds or swaps, which can potentially lead to measurement bias.

Risky bonds do not have fixed cash flows although the contractual cash flows of the bonds might be fixed. In credit event, the realized cash flows may be very different from the promised ones and highly variable. It is the possibility of a non-contractual change in the cash flows that makes the main difference between credit risky corporate bonds and the treasury bonds. The conventional OAS-spreads method described in (1) indeed assumes the fixed cash flows, which is a conceptual flaw of the model with exception where recovery rate is zero. As such, the model does not adequately reflect the nature of the credit risk faced by investors